Used Nuclear Fuel Perspective
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Most of the serious environmental contamination problems with the nuclear fuel cycle have been related to processing irradiated fuel reprocessing in the liquid state. The Purex process and its derivatives are based on nitric acid which, when laden with fission fragments, is very aggressive. Therefore, I suggest that liquid fuel reprocessing be minimized.

The DUPIC fuel process for exhausted PWR or BWR fuel, which is in advanced stages of adoption in China and Korea is a dry process. This technology uses only solid state thermal processing of the fuel. Uranium is not separated from plutonium or the other transuranics. This process is, in China and Korea, intended to be used with their CANDU reactors which, because of their superior neutronics, can utilize exhausted PWR fuel after repackaging with no added fissile content. In the CANDU reactor, the DUPIC fuel should perform better than normal CANDU fuel and should achieve between 30 and 50% additional burnup.

The current CANDU reactor cannot be licensed in the US because of a positive void reactivity coefficient. The AECL has the preliminary design of a heavy water reactor moderated reactor which does not have a positive void reactivity problem and should be able to be licensed in the US. This newer reactor, the ACR1000, has almost the neutron economy of the CANDU and is intended to be able to burn DUPIC fuel.

I suggest that a fleet of ACR1000s' (starting with 2 until the program is established) be operated by a federal agency. They should burn PWR/BWR DUPIC fuel. (If necessary, our nuclear fuel could be reprocessed by either the Chinese or Koreans until a domestic facility is completed.) The use of DUPIC fuel would be more expensive than conventional PWR or BWR with virgin fuel but not prohibitively so. Because it is more expensive, it would need to be government operated or supported. Electricity sales should, once the program is running cover the costs. The used DUPIC fuel would be stored at the reactor until the next stage of reprocessing is available.

The next stage of process should separate the uranium from the DUPIC fuel. (Optionally, this could be done by a fluorine oxidation rather than a wet process.) The residue (which may include some fission fragments) would then be processed for use in either a fast reactor or a molten salt reactor and reduced to all fission fragments.

Implementing DUPIC fuel with the ACR1000 would followed by separation of the uranium:
Permit the consolidation of used commercial fuel at one location prior to the availability of a repository.
Extract an additional 35% energy from the used fuel before final reprocessing.
Require at most one wet processing of used fuel.
Reduce the exhausted uranium well below natural uranium fissile content.
Avoid inserting uranium into the final processing fast reactor.
Minimize high activity transuranic materials going to a final repository.